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09/768,695	01/24/2001	Andrew C. Gallagher	81760THC	3716

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EXAMINER	
MISLEH, JUSTIN P	
ART UNIT	**PAPER NUMBER**
2612	3

DATE MAILED: 07/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/768,695	GALLAGHER ET AL.	
	Examiner	Art Unit	
	Justin P Misleh	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1 - 17 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1 - 17 is/are rejected.

7)☒ Claim(s) 2 and 6 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 24 January 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because of its length.

A brief abstract of the technical disclosure in the specification must commence on a separate sheet, preferably following the claims, under the heading "Abstract" or "Abstract of the Disclosure." The abstract in an application filed under 35 U.S.C. 111 may not exceed 150 words in length. The purpose of the abstract is to enable the United States Patent and Trademark Office and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure. The abstract will not be used for interpreting the scope of the claims. See MPEP § 608.01(b).

Appropriate correction is required.

2. The disclosure is objected to because of the following informalities: inconsistencies.

o Reference sign 53 is first described in reference to figure 5; however, it is shown in figures 2 and 3, both of which were described prior to figure 5.

o On page 17, line 7 states, "signal b(x,y)"; however, figure 7 shows h(x,y).

Appropriate correction is required.

Claim Objections

3. **Claim 2** is objected to because of the following informalities: antecedent basis issue.

The claim language recites therein, "wherein the image sensor", however Claim 1 does not introduce an image sensor rather introduces "an image sensing device". For the purposes of examination, the Examiner will interpret Claim 2 using "wherein the image sensing device".

Appropriate correction is required.

4. **Claim 6** is objected to because of the following informalities: indefinite claim language.

The claim language recites therein, "wherein the slow response photosites have a response that is slower by at least one stop compared to the fast photosites". Claim 1 simply defines fast photosites as having a predetermined response to light exposure and slow photosites with a slower response to the same light exposure. In camera technology, a "stop" corresponds to the size in an aperture opening in a camera. However, neither has Claim 1 nor 6 introduced a relationship between the "fast" and "slow" photosites and aperture opening nor have they introduced a relationship between the size of the aperture opening corresponding to "one stop". For those reasons, Claim 6 is indefinite. For the purposes of examination, the Examiner will interpret Claim 6 as the following "wherein the slow response photosites have a response that is slower compared to the fast photosites".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 1, 3 – 6, and 8 – 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Merrill in view of Melen.

7. For **Claims 1, 12, and 17**, Merrill disclose, as shown in figures 1A, 6, and 7 and as stated in column 4 (lines 53 – 61), 10 (lines 33 – 39), and 11 (lines 19 – 28 and 40 – 54), an image capture system (see figure 7) for generating an extended dynamic range digital image, comprising:

a) a image sensing device having fast photosites (Photodiode 12) with a predetermined response to light exposure interspersed with slow photosites (Photodiode 14) with a slower response to the same light exposure for producing a sparsely sampled high resolution digital image having fast pixel values produced by the fast photosites and slow pixel values produced by the slow photosites (see explanation below);

Merrill employs an image-sensing device comprised of at least an image sensor (200; see figure 6) wherein the image sensor is an active pixel sensor comprised of larger photodiodes (12; "fast") interspersed among (14; "slow") photodiodes, wherein the image capture system uses both the "fast" and the "slow" photosites to expand the dynamic range. Furthermore, Merrill disclose, as shown in figure 7 and as stated in column 11 (lines 2- 35), "a block diagram of an illustrative digital camera employing three" image sensor arrays (200). A color-separating prism (232) is shown mounted inside light-tight housing (234). Attached to the three output faces of prism (232) are the three image sensors(246R, 246G, and 246B), aligned in such a way that the color-separated images fall on their active areas in registration. Each on-board assembly includes an imaging array of pixel sensors like that partially depicted in figure 6.

However, Merrill does not disclose a digital image processor for expanding the dynamic to yield a full resolution digital image having an extended dynamic range. Although, Merrill clearly states, in column 2 (lines 33 – 56), "one problem encountered with prior-art imagers is a limitation on the dynamic range of images that can be captured by the array. Images that contain both low-light-level pixels and high-light-level pixels could be improved if the dynamic range of the imager could be increased. In an active pixel sensor, the sensitivity of measuring charges generated by photons can be described as a charge-to-voltage gain or light-to-output-voltage transfer gain. Voltage dependence of the photodiode capacitance and other capacitances, and nonlinearities of the readout amplifier transistor can make the gain vary with level, so that the overall transfer curve may be somewhat nonlinear. A nonlinearity in which higher light intensities give lower gains is said to be compressive. A significant degree of compressive nonlinearity can have a beneficial effect on the signal-to-noise ratio of the image at low light levels, and can thereby enhance the usable dynamic range of the imager." Therefore, since it is objective of Merrill to increase the dynamic range of the imager, it would have been obvious to one with ordinary skill in the art to have provided a digital image processor for processing the outputs of the "fast" photodiodes (12) and the "slow" photodiodes (14) to yield an expanded dynamic range high resolution digital image.

Lastly, Merrill does not disclose, in the very least, an encoder for reducing the dynamic range of the full resolution digital image to fit within the dynamic range of a storage space and a digital image store.

On the other hand, Melen also disclose an image capture system for generating and storing an extended dynamic range digital image. More specifically, Melen teach, as shown in

figures 1 and 4(c) and as stated in columns 2 (lines 47 – 51), 3 (lines 9 – 49), 4 (lines 52 – 66), and 6 (lines 4 – 11), the image capture system comprising:

c) an encoder (comprised of components 101, 118, 124, and 122) for reducing the dynamic range of the full resolution digital image to fit within the dynamic range of a storage space (102) having a dynamic range less than the dynamic range of the full resolution digital image to form a limited dynamic range digital image (120) represented in the storage space (see column 4, lines 52 – 56) and for producing a residual image (image signal 103, corresponding to image signal 110, after being output from component 101 and being input into component 124) representing a difference between the full resolution digital image (image signals 110 and 112) and the limited dynamic range digital image (120) that can be used with the limited dynamic range digital image to reconstruct the full resolution digital image (see column 3, lines 35 – 39); and

d) a digital image store (102) for storing the limited dynamic range digital image in association with the residual image.

In summary, Melen teaches, that the full resolution digital image is comprised of image signals 110 and 112 and is broken into a residual image (image signal 103 input into component 124) and a limited dynamic range digital image (120), both of which are stored in the digital image store (102) for reconstruction. As stated in column 3 (lines 35 – 49), at the time the invention was made, one with ordinary skill in the art would have been motivated to include an encoder and a digital image store, as taught by Melen, in the image capture system, disclosed by Merrill, as a means to store a high resolution wide dynamic range digital image which can be accurately reconstructed for display at a later time. Therefore, at the time the invention was

made, it would have been obvious to one with ordinary skill in the art to have included an encoder and a digital image store, as taught by Melen, in the image capture system, disclosed by Merrill.

As for **Claims 3, 13, and 14**, Merrill employs an image capture system (see figure 7) is comprised of three identical image sensors (200) wherein each the image sensors (200) is interspersed with "fast" photosites (photodiode 12) and "slow" photosites (photodiode 14), wherein the image capture system uses both the "fast" and the "slow" photosites to expand the dynamic range.

8. As for **Claim 4**, Merrill shows through obviousness (see rejection of Claim 1), as shown in figure 7, a digital camera comprising a digital image processor for expanding the dynamic range of an image included in the digital camera. However, Merrill does not disclose wherein the image sensing device is located in a digital camera and the digital image processor is located in a host computer separate from the digital camera. **Official Notice** is taken that both the concepts and advantages of locating a digital image processor in a host computer separate from the digital camera are well known and expected in the art. It would have been obvious to one with ordinary skill in the art to have included a digital image processor in a host computer separate from the digital camera as means to perform advanced image processing such as photofinishing.

9. As for **Claim 5**, Merrill shows through obviousness (see rejection of Claim 1), as shown in figure 7, a digital camera comprising a digital image processor for expanding the dynamic range of an image included in the digital camera.

10. As for **Claim 6** (please see objection above), Merrill discloses, as described above, wherein the slow response photosites have a response that is slower compared to the fast photosites.

11. As for **Claim 8**, Melen teaches, as shown in figure 2 and as stated in column 3 (lines 35 – 39), an image reconstructor (see figure 2) that employs the residual image (128) and the limited dynamic range digital image (126) to form a reconstructed full resolution digital image.

12. As for **Claim 9**, Melen teaches, as shown in figure 2, wherein the image reconstructor applies an image modification (resize and position component 201) to the reconstructed full resolution digital image.

13. As for **Claim 10**, Melen teaches, as shown in figure 1 and as stated in column 3 (lines 9 – 29), the limited dynamic range digital image (126) and the residual image (128) are stored individually in the digital image store (102). There is no indication or suggestion whatsoever in Melen as to the combination prior to storage of the two images, hence they are separate image files. However, **Official Notice** is taken that both the concepts and the advantages are storing two digital images in the same digital image file are well known and expected in the art. It would have been obvious to one with ordinary skill in the art have stored two digital images in the same digital image file as means to decrease the number of files stored in the storage space, thereby increasing the speed of image reconstruction.

14. As for **Claim 11**, Melen teaches, as shown in figure 1 and as stated in column 3 (lines 9 – 29), the limited dynamic range digital image (126) and the residual image (128) are stored individually in the digital image store (102). There is no indication or suggestion whatsoever in

Melen as to the combination prior to storage of the two images, hence they are separate image files.

15. As for **Claim 15**, the claim language requires a residual image representing a luminance difference and a residual image representing a chrominance difference are produced and stored. This particular claim language does not require two separate residual images, rather, interpreted broadly, can be a single residual image comprising both luminance and chrominance differences. Melen does teach of a residual image comprising both luminance and chrominance differences (see Examiner's residual image interpretation above).

16. As for **Claim 16**, the claim language requires wherein the residual image is stored as tiles representing subsets of pixels in separate tags in an image files. Claim 16 is simply requiring that the residual image be stored in a TIFF file format. Melen, however, only teaches of storing the residual image in JPEG file format. **Official Notice** is taken that both the concepts and advantages of storing an image in TIFF file format are well known and expected in the art. It would have been to obvious to one with ordinary skill in the art to have stored the residual image in TIFF file format, rather than JPEG file format, because TIFF file format is a loss-less compression format as opposed to the lossy JPEG compression format.

17. **Claims 2 and 7** are rejected under 35 U.S.C. 103(a) as being unpatentable over Merrill in view of Melen in further view of Bayer.

18. As for **Claim 2**, Merrill employs an image-sensing device comprised of at least an image sensor (200; see figure 6) wherein the image sensor is an active pixel sensor comprised of larger photodiodes (12; "fast") interspersed among (14; "slow") photodiodes, wherein the image

capture system uses both the "fast" and the "slow" photosites to expand the dynamic range. Furthermore, Merrill disclose, as shown in figure 7 and as stated in column 11 (lines 2- 35), "a block diagram of an illustrative digital camera employing three" image sensor arrays (200). A color-separating prism (232) is shown mounted inside light-tight housing (234). Attached to the three output faces of prism (232) are the three image sensors(246R, 246G, and 246B), aligned in such a way that the color-separated images fall on their active areas in registration. Each on-board assembly includes an imaging array of pixel sensors like that partially depicted in figure 6.

However, Merrill does not disclose a color image sensor having a color filter array and a color filter array interpolator for interpolating color values.

On the other hand, Bayer also disclose an image sensing device. More specifically, Bayer teach, as shown in figures 1A, 1B, and 4 and as stated in columns 3 (lines 51 – 68), 4 (lines 1 and 2), and 13 (lines 13 – 30), color image sensor (32) having an array of photosites (22) and a color filter array (24) arranged over the array of photosites; wherein the image processor includes a color filter array interpolator (40) for interpolating color values at all of the photosites. As stated in column 2 (lines 9 – 15), at the time the invention was made, one with ordinary skill in the art would have been motivated to include a color image sensor having an array of photosites and a color filter array, as taught by Bayer, in the image capture system, taught by Merrill in view of Melen, as a means to reduce optical and image registration problems and to provide a more rugged camera structure. Therefore, at the time the invention was made, it would have been obvious to one with ordinary skill in the art to have included a color image sensor having an array of photosites and a color filter array, as taught by Bayer, in the image capture system, taught by Merrill in view of Melen.

19. As for **Claim 7**, Bayer teaches wherein the color filter array is a Bayer array.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following is a brief description of each of the prior art:

- **Prior Art C, D, E, and F** disclose an apparatus and corresponding method for expanding the dynamic range of image signals by varying the exposure times and/or readout method of a single image sensors or a plurality of image sensors.

- **Prior Art G, H, N, and O** disclose a image sensor comprising "fast photosites" interspersed with "slow photosites" wherein the "fast" and "slow" photosites are created by varying the size and/or shape of the microlens array disposed therein.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Justin P Misleh whose telephone number is 703.305.8090. The Examiner can normally be reached on Monday through Thursday from 7:30 AM to 5:30 PM and on alternating Fridays from 7:30 AM to 4:30 PM.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Wendy R Garber can be reached on 703.305.4929. The fax phone number for the organization where this application or proceeding is assigned is 703.872.9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JPM
June 25, 2004

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